REMARKS

Claims 1, 2, 6-22 and 24-26 are all of the claims presently pending in the application. Claims 2, 6, 9, 16 and 19 have been editorially amended to more particularly define the invention. Claim 23 has been canceled without prejudice or disclaimer.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Entry of this Amendment is believed proper since no new issues are being presented to the Examiner which would require further consideration and/or search.

Applicant appreciates the Examiner's indication that claims 8, 10, 11, 15, 18, and 20 would be allowable if rewritten in proper independent form. Applicant submits, however, that all of claims 1-2, 6-22 and 24-26 are allowable over the cited prior art references.

Claims 9 and 19 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Claims 1, 2, 6, 7, 9, 12-14, 16, 17, 19, 21, 22 and 24-26 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Hata (U.S. Patent Publication No. 2002/0074558).

These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

The claimed invention (e.g., as defined by exemplary claim 1) is directed to a III group nitride system compound semiconductor light emitting element. The light emitting element includes a transparent substrate, a III group nitride system compound semiconductor formed on a surface of the transparent substrate and a convex light trapping member that is formed over the surface of the transparent substrate. The convex light trapping member has a refractive index that is substantially equal to a refractive index of the transparent substrate or is closer to the refractive index of the transparent substrate than a refractive index of the III group nitride system compound semiconductor layer.

Conventional III group nitride system compound semiconductor layers are grown on a

mirror-finished surface of a sapphire substrate to form a light emitting element. Because of the large difference in refractive index between the sapphire substrate and the III group nitride system compound semiconductor layer, the critical angle at the interface of the sapphire substrate and the semiconductor layer is no more than approximately 47 degrees. Therefore, some component of light emitted from the semiconductor layer can be returned to the semiconductor layer after being subjected to total reflection at the interface. This prevents light emitted from the semiconductor layer from being taken out efficiently.

The claimed invention of exemplary claim 1, on the other hand, provides a convex light trapping member that is formed over the surface of the transparent substrate. The convex light trapping member has a refractive index that is substantially equal to a refractive index of the transparent substrate or that is closer to the refractive index of the transparent substrate than a refractive index of the III group nitride system compound semiconductor layer (e.g., see Application at page 3, line 29 through page 4, line 12).

Thus, light entering into the light trapping member is directly transmitted through the transparent substrate and discharged outside of the substrate (e.g., see Application at page 9, lines 1-3). This allows the claimed invention to improve the light extraction efficiency in the direction of the transparent substrate (e.g., see Application at page 14, lines 4-5).

II. THE 35 U.S.C.§ 112, SECOND PARAGRAPH REJECTION

The Examiner has rejected claims 9 and 19 under 35 U.S.C. § 112, second paragraph, as being indefinite. Specifically, the Examiner stated that it is unclear what is intended by the limitation "an entirety of the surface of the substrate". Applicant has amended claims 9 and 19 to overcome the Examiner's rejection.

Applicant respectfully requests the Examiner to withdraw this rejection.

III. THE PRIOR ART REFERENCE

The Examiner alleges that Hata teaches the claimed invention of claims 1, 2, 6, 7, 9, 12-14, 16, 17, 19, 21, 22 and 24-26. Applicant submits, however, that there are elements of the claimed invention which are neither taught nor suggested by Hata.

That is, Hata does not teach or suggest "*wherein the light trapping member has a refractive index substantially equal to a refractive index of the transparent substrate or closer to the refractive index of the transparent substrate than a refractive index of the III group nitride system compound semiconductor layer*" as recited in independent claim 1, and similarly in independent claims 6 and 22.

The Examiner attempts to rely on Figure 1 and paragraphs [0031] to [0034] of Hata to support his allegations. The Examiner, however, is clearly incorrect.

Hata merely discloses a sapphire substrate (1) having a buffer layer (31) and an N-type nitride gallium type compound semiconductor layer (3) disposed thereon. The N-type nitride gallium type compound semiconductor layer (3) provides a light emitting layer (4). A phosphor layer (2) coated with a transparent conductor film is provided between the semiconductor layer (3) and the sapphire substrate (1) (see Hata at page 3, paragraph [0043]).

Nowhere, however, in this passage (nor anywhere else for that matter) does Hata teach or suggest that the convex light trapping member (e.g., presumable the phosphor layer for what the Examiner is relying on) has a refractive index that is substantially equal to a refractive index of the transparent substrate or that is closer to the refractive index of the transparent substrate than a refractive index of the III group nitride system compound semiconductor layer.

Applicant submits that MPEP 2144.05 states that "[t]he law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims".

Applicant has discovered a specific relationship between the refractive index of the convex light trapping member and that of the transparent substrate. As pointed out above, the claimed refractive index relationship allows light entering into the light trapping member to be directly transmitted through the transparent substrate and discharged outside of the substrate (e.g., see Application at page 9, lines 1-3). This allows the claimed invention to improve the light extraction efficiency in the direction of the transparent substrate (e.g., see Application at page 14, lines 4-5).

Applicant submits that a specific range or other variable in a claim may provide

patentable weight to a claim if the applicant can show that the particular range is critical (see M.P.E.P. § 2144.05). In order to anticipate this claimed ratio, the specific limitation must be disclosed in the reference with "sufficient specificity to constitute an anticipation under the statute" (see M.P.E.P. § 2131.03). As stated above, Hata does not disclose a specific relationship between the refractive index of the convex light trapping member and the transparent substrate, let alone teach or suggest the specific relationship recited in claim 1 (and similarly claims 6 and 22). The Examiner does not even allege that Hata teaches this claimed relationship. The Examiner must point out where Hata teaches or suggests this claimed relationship. Hata merely teaches, as relied upon by the Examiner, a phosphor layer made of aluminum oxide and a sapphire substrate.

Even assuming, however, that the Examiner does allege that the claimed relationship of the refractive index of the convex light trapping member and the transparent substrate is obvious in view of Hata, Applicant submits that the MPEP provides that "[a] particular parameter must first be recognized as a result-effective variable, i.e., **a variable which achieves a recognized result**, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation" (MPEP at §2144.05) (emphasis added). Here, the only results that Hata suggests as being affected by the use of Al_2O_3 as a phosphor layer is that Al_2O_3 provides fluorescent properties and allows the nitride type compound semiconductor light emitting element to convert the wavelength of the emitted light (see Hata at paragraphs [0034] and [0049]). This is clearly unrelated to optimizing a relationship between the refractive index of the convex light trapping member and the transparent substrate for providing the desired results of the claimed invention.

That is, nowhere does Hata teach or suggest that the relationship between the refractive index of the convex light trapping member and the transparent substrate may have any effect on the transmission of the light entering into the light trapping member or the light extraction efficiency in the direction of the transparent substrate. Certainly, Hata does not teach or suggest that the relationship between the refractive index of the convex light trapping member and the transparent substrate can cause light entering into the light trapping member to be directly transmitted through the transparent substrate and discharged outside of the

substrate. Therefore, it would be clearly unreasonable to suggest that these references teach or suggest that a relationship between the refractive index of the convex light trapping member and the transparent substrate is merely a result-effective variable.

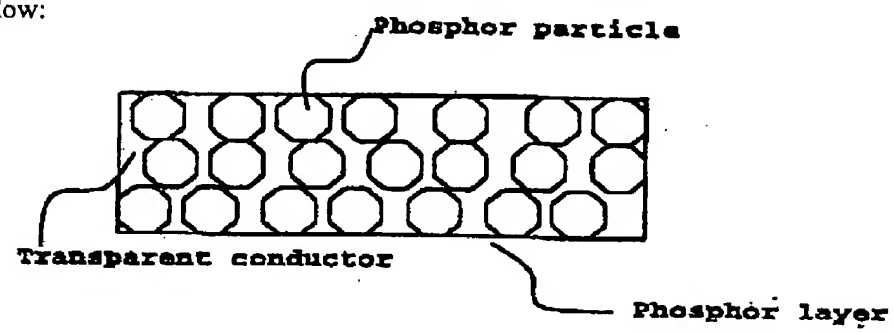
Furthermore, as pointed out in Applicant's Amendment filed on August 10, 2004, the "convex" light trapping member (2) relied upon by the Examiner is actually a phosphor layer (2) (see Hata at page 3, paragraph [0043]). The phosphor layer (2) allows the light emitting layer to emit multi-colored light by excitation of the light emitted from the light emitting layer (see Hata at page 2, paragraph [0031]). Through phosphorescence, the phosphor layer allows the light emitting element to convert the wavelength of emitted light (see Hata at page 3, paragraph [0049]). Hata does not teach trapping light to directly transmit that light through a transparent substrate, as taught by the claimed invention. Hata teaches providing a phosphor layer to excite light emitted from a light emitting layer so that multi-colored light can be emitted by the excitation.

The claimed invention, on the other hand, improves the light extraction efficiency in the direction of the transparent substrate by having light entering into the light trapping member directly transmitted through the transparent substrate and discharged outside of the substrate by providing a light trapping member having a refractive index that is substantially equal to a refractive index of the transparent substrate.

Moreover, the Examiner's allegation (see Office Action at page 4, line 16) that "[t]he index of refraction of member 2 is still the index of refraction of aluminum oxide the main constituent. Light is reflected at the same critical angle, etc." (emphasis added by Applicant) is clearly incorrect.

Hata discloses that "powder of phosphor" (see paragraph [0045] of Hata) is used to fabricate a phosphor layer (2), and the phosphor layer (2) is formed such that "[b]y applying a transparent conductor film on the phosphor layer, a transparent conductor will be introduced between the phosphors forming the phosphor layer during the application of a transparent conductor film. Accordingly, a conductive phosphor layer is provided" (see paragraph [0032] of Hata). The phosphor particles (powder) are dispersed in a continuous transparent conductor layer and such a transparent conductor layer with phosphor particles dispersed

therein is called the phosphor layer in Hata. The image of the phosphor layer is shown below:



As such, a light component entering into the phosphor layer is absorbed in the phosphor particle or another light component is repeatedly reflected on the surface of the phosphor particle without being absorbed therein. Furthermore, though the light component absorbed in the phosphor particle is wavelength-converted by the phosphor and then re-emitted, light is scattered in all directions due to the irregular shape of the phosphor particle. This scattering is illustrated in the attached article, Narendran, N. et al., "Solid-state lighting: Failure analysis of white LEDs" (see Figure 1 of Narendran et al.).

As a result, light entering into the phosphor layer as disclosed in Hata is always scattered in all directions.

Thus, it is apparent that the phosphor layer of Hata has no index of refraction because the refraction of light cannot be measured in a certain angle due to the scattering of light in the phosphor layer.

As explained above, since the index of refraction of member (2) of Hata is unknown due to the scattering of light in the phosphor layer, it cannot be concluded that it is "still the index of refraction of aluminum oxide the main constituent" as alleged by the Examiner. Similarly, it cannot be concluded that "[l]ight is reflected at the same critical angle, etc." as alleged by the Examiner.

Therefore, Applicant submits that there are elements of the claimed invention that are not taught or suggest by Hata. Therefore, the Examiner is respectfully requested to withdraw this rejection.

IV. FORMAL MATTERS AND CONCLUSION

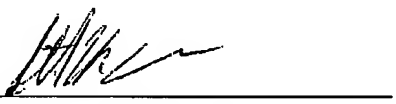
In view of the foregoing, Applicant submits that claims 1, 2, 6-22 and 24-26, all of the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: January 4, 2005



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PTGF-03081
HIR.079

CERTIFICATION OF FACSIMILE TRANSMISSION

I hereby certify that I am filing this § 1.116 Amendment by facsimile with the United States Patent and Trademark Office to Examiner Jerome Jackson, Jr., Group Art Unit 2815 at fax number (703) 872-9306 this 4th day of January, 2005.

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